



California Regional Water Quality Control Board

San Francisco Bay Region

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TO: Professor James Kirchner, University of California, Berkeley
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FROM: Richard E. Looker, Water Resources Control Engineer
**SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD**

DATE: **October 24, 2003**

SUBJECT: PEER REVIEW OF TECHNICAL BASIS OF PROPOSED BASIN PLAN
AMENDMENT FOR MERCURY TMDL FOR SAN FRANCISCO BAY

Dear Reviewers,

The San Francisco Bay Regional Water Quality Control Board is developing a Basin Plan amendment to establish a mercury TMDL for San Francisco Bay. The amendment includes numeric targets, load allocations, and implementation plan for the TMDL. The draft staff report and proposed Basin Plan amendment language (both attached) are now available for your review. The staff report summarizes the technical information considered in developing the TMDL and contains required regulatory analyses for the proposed amendment. We hope that you will be able to complete your review in about 45 days (second week of December 2003). If you will have difficulty in meeting this schedule, please let me know. We sincerely apologize for the delay in getting this information ready for your review.

This memo highlights key technical issues for each TMDL element to help focus your review. Additional introductory and background information is available in the first few sections of the staff report.

1 The Problem Statement

This section of the report describes the basis for concluding that mercury impairs San Francisco Bay, including the water quality standards not being met. High levels of mercury have been found in fish, including the fish humans eat, and birds, including the endangered California clapper rail and least tern. Mercury levels in San Francisco Bay exceed the Basin Plan objective for bioaccumulation and threaten beneficial uses, such as sport fishing, wildlife habitat, and preservation of rare and endangered species.

- a) *Have we reasonably described the nature of the water quality problem of mercury in San Francisco Bay?*

2 Mass Budget Approach

This section of the staff report presents our approach to simplifying the physical system to facilitate the TMDL analysis. The analysis employs a steady-state box model for San Francisco Bay that treats the bay as two compartments -- water and active sediment. Treating the entire bay as two compartments necessarily ignores physical, chemical, and biological heterogeneity that may be relevant. However, relying on a simple model allows us to identify reasonable solutions to the problem without over-interpreting available data.

- a) Have we clearly described the steady-state box model employed in the analysis?*
- b) Have we reasonably supported our rationale for employing a steady-state box model for the purpose of the mercury TMDL analysis?*

3 Source Assessment

The source assessment relies on available information to describe and quantify dissimilar sources like watershed background inputs, in-bay dredge disposal, Central Valley inputs through the delta, atmospheric deposition, storm water and wastewater discharges, and inputs from local mining sources. The magnitude of all mercury sources is expressed in units of kilograms per year. A substantial fraction of the mercury that enters the bay is bound to sediment. Therefore, the source assessment also contains estimates of mercury concentration in sediment and sediment loads (in kg/year).

- a) Are the source categories clearly defined?*
- b) Are the source estimates and estimation methodologies clearly stated for each source category?*
- c) In view of the data available, are the estimation methods employed reasonable and scientifically sound?*

4 Numeric Targets

Numeric targets are measurable conditions that demonstrate attainment of water quality standards. A numeric target can be a numeric water quality objective or a numeric interpretation of a narrative objective. This TMDL proposes three numeric targets: a mercury fish tissue target to protect humans consuming bay fish; a mercury bird egg target to protect wildlife; and a sediment target to track total mercury loads and compliance with the load allocations. The fish tissue and bird egg targets are used to guide other management actions needed to minimize mercury methylation and accumulation in the food web.

- a) Are the target derivations clearly stated and adequately supported by available information?*

5 Linkage Analysis

The linkage analysis establishes the connections between mercury sources and the numeric TMDL targets. The basis of the linkage analysis is the understanding that mercury entering the bay binds to sediment and is transported to methylating regions of the bay. Methylmercury is then taken into the food web, where it accumulates in fish tissue and bird eggs. To establish

appropriate load allocations later in the analysis, the relationship between loads and targets must be determined.

- a) *Are the linkages between sources and the numeric targets clearly stated and scientifically sound?*
- b) *Have we presented a plausible argument that reducing sources of mercury will result in attainment of proposed targets?*
- c) *There are several key assumptions put forth in this section to complete the linkage between mercury loads and fish tissue mercury concentrations. In light of available data, are these assumptions reasonable?*

6 Load Allocations

The TMDL requires that we allocate a load to each of the source categories in such a fashion that the numeric targets and, in turn, the water quality standards can be achieved if sources are reduced to the sum of the load allocations. A load allocation has been proposed for each source category and for individual discharges within certain source categories. Because of the scarcity of quantitative information about the relative bioavailability of mercury from different sources and the amount of mercury from each source converted to methylmercury, we based our allocations on total mercury and assumed, therefore, that all mercury sources were equivalent in terms of bioavailability.

- a) *Are the load allocations and calculation methodologies clearly stated for each source category?*
- b) *Are the calculation methodologies for arriving at categorical load allocations reasonable?*
- c) *When load allocations are further distributed among contributing entities (e.g. wastewater and urban stormwater), is the methodology for distributing the load allocation clearly stated and reasonable?*
- d) *Given the scarcity of information concerning relative bioavailability and the degree to which mercury from different sources undergoes methylation, is it reasonable for us to assume that all mercury sources are equally bioavailable?*
- e) *There is a discussion in this section regarding the response time of sediment concentrations that makes use of a box model to generate an estimated response time on the order of 100 years. Based on the available information, is this a reasonable conclusion about physical constraints on the expected response time of mercury concentrations in sediments?*

7 Margin of Safety

TMDLs must include a margin of safety. This may be done in one of two ways. The margin of safety may be explicit in that, once the assimilative capacity of the waterbody is calculated, some portion of the assimilative capacity is not allocated to sources. Alternately, the margin of safety may be implicit. We have taken the latter approach by making conservative choices throughout the analysis when appropriate to afford a tangible but unquantified margin of safety. We have not proposed an explicit margin of safety because we did not have sufficient information for a formal propagation of error and any other explicit margin of safety could not be supported by

existing information and would, thus, be arbitrary. The margin of safety discussion is presented in the 'Linkage Analysis' section of the report.

- a) Have we adequately identified the limitations of the technical information available to us?*
- b) Is the method of ensuring an implicit margin of safety clearly stated and reasonable?*

8 Implementation Actions

The implementation plan contains proposed actions to reduce mercury loading to the bay and to reduce the amount of mercury being methylated and introduced into the food web. The plan also specifies a program of monitoring and special studies to address the various areas of uncertainty so that, moving forward with better information, increasingly effective actions can be taken to control the mercury problem.

- a) Are the actions described in this section reasonable in light of available data?*
- b) Is the adaptive approach to implementation adequately explained and reasonable?*
- c) Is the proposed monitoring program adequate to evaluate progress toward achieving the sediment, fish tissue, and bird egg targets?*
- d) Have we clearly stated the key management questions?*
- e) Have we stated a reasonable approach and schedule for addressing each of the questions?*

9 Overarching questions

Of course, your review is not limited to addressing only the specific questions we pose above. Additionally, we would like you to contemplate the following "big picture" questions:

1. Are data used in the report reliable and appropriate, and is the treatment of the data defensible?
2. Does the report as a whole support its scientific conclusions and recommendations?
3. Does the analysis present a sufficiently compelling scientific justification to proceed with the TMDL adoption and implementation plan as proposed?

If you are interested, I have background material on TMDLs that may aid your review of the mercury-related material. I can also provide any of the documents cited in the staff report. Please do not hesitate to call or email me if you would like background material or if you have questions about this project.

Best Regards,

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